APPENDIX F
NOISE AND VIBRATION ASSESSMENT

TASMAN EAST SPECIFIC PLAN NOISE AND VIBRATION ASSESSMENT

Santa Clara, California

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INTRODUCTION

The Tasman East Specific Plan would create the framework to develop up to 4,500 dwelling units and up to 106,000 square feet of retail space including a 25,000 square-foot grocery store. A 600-student school is also envisioned as part of the plan. The urban school would be a ground floor use within a mixed-use building in close proximity to open space outlined in the current Specific Plan. The project area is an existing industrial neighborhood, 46 acres in size, and is bounded by Tasman Drive to the south, the Guadalupe River to the east, the Santa Clara Golf Club to the north, and Lafayette Street to the west.

This report evaluates the project's potential to result in significant noise and vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into four sections: 1) the Setting Section, which provides a brief description of the fundamentals of environmental noise and ground-borne vibration, summarizes applicable regulatory criteria, and discusses the results of the noise and vibration monitoring surveys completed to document existing conditions; 2) the Assumptions and Methodology Section; 3) the General Plan Consistency Section, which discusses land use compatibility utilizing noise- and vibration-related policies in the City's General Plan; and, 4) the Impacts and Mitigation Measures Section, which describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents mitigation measures to reduce impacts to less-than-significant levels.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (*frequency*) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the *sound level meter*. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night – because excessive noise interferes with the ability to sleep – 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 p.m. – 10:00 p.m.) and a 10 dB addition to nocturnal (10:00 p.m. – 7:00 a.m.) noise levels. The *Day/Night Average Sound Level* (L_{dn}) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Fundamentals of Ground-borne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous vibration levels produce.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related ground-borne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess ground-borne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Studies have shown that the threshold of perception for average persons is in the range of 0.008 to 0.012 in/sec PPV. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Damage caused by vibration can be classified as cosmetic or structural. Cosmetic damage includes minor cracking of building elements (exterior pavement, room surfaces, etc.). Structural damage includes threatening the integrity of the building. Damage resulting from construction related vibration is typically classified as cosmetic damage. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

Railroad and light-rail operations are potential sources of substantial ground vibration depending on distance, the type and the speed of trains, and the type of railroad track. People's response to ground vibration has been correlated best with the velocity of the ground. The velocity of the ground is expressed on the decibel scale. The reference velocity is 1 x 10^{-6} in./sec. RMS, which equals 0 VdB, and 1 in./sec. equals 120 VdB. Although not a universally accepted notation, the abbreviation "VdB" is used in this document for vibration decibels to reduce the potential for confusion with sound decibels.

Typical background vibration levels in residential areas are usually 50 VdB or lower, well below the threshold of perception for most humans. Perceptible vibration levels inside residences are attributed to the operation of heating and air conditioning systems, door slams and foot traffic. Construction activities, train operations, and street traffic are some of the most common external sources of vibration that can be perceptible inside residences. Table 4 illustrates common sources of vibration and the association to human perception or the potential for structural damage.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 p.m. and 7:00 a.m.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 p.m.to 10:00 p.m. and after addition of 10 decibels to sound levels measured in the night between 10:00 p.m. and 7:00 a.m.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

TABLE 3 Reactions of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

TABLE 4 Typical Levels of Groundborne Vibration

Human/Structural Response	Velocity Level, VdB	Typical Events (50-foot setback)
Threshold, minor cosmetic damage	100	Blasting, pile driving, vibratory compaction equipment
		Heavy tracked vehicles (Bulldozers, cranes, drill rigs)
Difficulty with tasks such as reading a video or computer screen	90	
		Commuter rail, upper range
Residential annoyance, infrequent events	80	Rapid transit, upper range
Residential annoyance, occasional events		Commuter rail, typical Bus or truck over bump or on rough roads
Residential annoyance, frequent events	70	Rapid transit, typical
Approximate human threshold of perception to vibration		Buses, trucks and heavy street traffic
	60	
		Background vibration in residential settings in the absence of activity
Lower limit for equipment ultra-sensitive to vibration	50	

Source: Transit Noise and Vibration Impact Assessment, US Department of Transportation Federal Transit Administration, May 2006.

Regulatory Background - Noise

The State of California, the City of Santa Clara, and the Santa Clara County Airport Land Use Commission (ALUC), have established guidelines, regulations, and policies that limit noise exposure at noise sensitive land uses. Appendix G of the State of California Environmental Quality Act (CEQA) Guidelines is used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

State CEQA Guidelines. CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Exposure of persons to or generation of noise levels in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies;

(b) Exposure of persons to or generation of excessive ground-borne vibration or ground-borne noise levels;

(c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

(d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

(e) For a project located within an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels; or

(f) For a project within the vicinity of a private airstrip, if the project would expose people residing or working in the project area to excessive noise levels.

Pursuant to recent court decisions, the impacts of site constraints such as exposure of the proposed project to excessive levels of noise and vibration identified in Checklist Questions (a), (b), and (f) are not included in the Impacts and Mitigation Section of this report. These items are discussed in a separate section addressing the Noise and Land Use Compatibility of the project.

CEQA does not define what noise level increase would be considered substantial. Typically, project-generated noise level increases of 3 dBA L_{dn}/CNEL or greater would be considered significant where exterior noise levels would exceed the normally acceptable noise level standard (55 dBA L_{dn}/CNEL for residential land uses). Where noise levels would remain at or below the normally acceptable noise level standard with the project, noise level increases of 5 dBA L_{dn}/CNEL or greater would be considered significant.

2016 California Building Code, Title 24, Part 2. The current version of the California Building Code (CBC) requires interior noise levels attributable to exterior environmental noise sources to be limited to a level not exceeding 45 dBA L_{dn}/CNEL in any habitable room.

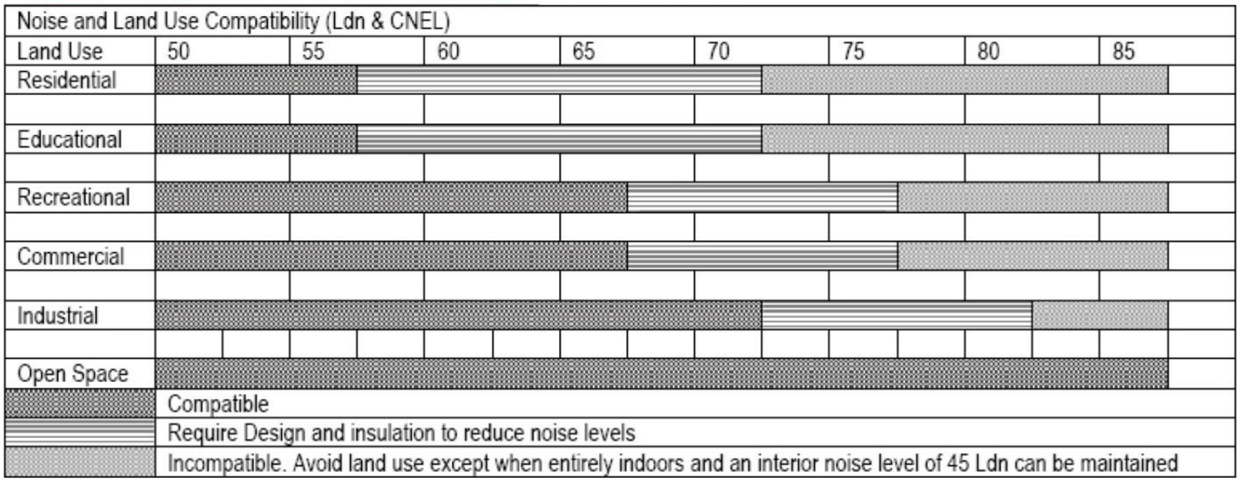
2016 California Building Cal Green Code. The State of California established exterior sound transmission control standards for new non-residential buildings as set forth in the 2016 California Green Building Standards Code (Section 5.507.4.1 and 5.507.4.2). The sections that pertain to this project are as follows:

> **5.507.4.1 Exterior noise transmission, prescriptive method.** Wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 when the building falls within the 65 dBA L_{dn} noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway noise source, as determined by the local general plan noise element.
>
> **5.507.4.2 Performance method.** For buildings located, as defined by Section 5.507.4.1, wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level ($L_{eq\ (1\text{-}hr)}$) of 50 dBA in occupied areas during any hour of operation.

The performance method, which establishes the acceptable interior noise level, is the method typically used when applying these standards.

City of Santa Clara General Plan. The City of Santa Clara's General Plan identifies noise and land use compatibility standards for various land uses and establishes policies to control noise within the community. Table 5.10-2 from the General Plan shows acceptable noise levels for various land uses. Residential land uses are considered compatible in noise environments of 55 dBA L_{dn}/CNEL or less. The guidelines state that where the exterior noise levels are greater than 55 dBA L_{dn}/CNEL and less than 70 dBA L_{dn}/CNEL, the design of the project should include measures to reduce noise levels to acceptable levels. Noise levels exceeding 70 dBA L_{dn}/CNEL at residential land uses are considered incompatible. Residential land uses proposed in noise environments exceeding 70 dBA L_{dn}/CNEL should generally be avoided, except when the residential use is entirely indoors and where interior noise levels can be maintained at 45 dBA L_{dn}/CNEL or less.

TABLE 5.10-2: GENERAL PLAN NOISE STANDARDS



Applicable goals and policies presented in the General Plan are as follows:

5.10.6-G1 Noise sources restricted to minimize impacts in the community.

5.10.6-G2 Sensitive uses protected from noise intrusion.

5.10.6-G3 Land use, development and design approvals that take noise levels into consideration.

5.10.6-P1 Review all land use and development proposals for consistency with the General Plan compatibility standards and acceptable noise exposure levels defined on Table 5.10-1.

5.10.6-P2 Incorporate noise attenuation measures for all projects that have noise exposure levels greater than General Plan "normally acceptable" levels, as defined on Table 5.10-1.

5.10.6-P3 New development should include noise control techniques to reduce noise to acceptable levels, including site layout (setbacks, separation and shielding), building treatments (mechanical ventilation system, sound-rated windows, solid core doors and baffling) and structural measures (earthen berms and sound walls).

5.10.6-P4 Encourage the control of noise at the source through site design, building design, landscaping, hours of operation and other techniques.

5.10.6-P5 Require noise-generating uses near residential neighborhoods to include solid walls and heavy landscaping along common property lines, and to place compressors and mechanical equipment in sound-proof enclosures.

5.10.6-P6 Discourage noise sensitive uses, such as residences, hospitals, schools, libraries, and rest homes, from areas with high noise levels, and discourage high noise generating uses from areas adjacent to sensitive uses.

5.10.6-P7 Implement measures to reduce interior noise levels and restrict outdoor activities in areas subject to aircraft noise in order to make Office/Research and Development uses compatible with the Norman Y. Mineta International Airport land use restrictions.

City of Santa Clara Municipal Code. The City's Municipal Code establishes noise level performance standards for fixed sources of noise. Section 9.10.40 of the Municipal Code limits noise levels at multi-family residences to 55 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and 50 dBA at night (10:00 p.m. to 7:00 a.m.). The noise limits are not applicable to emergency work, licensed outdoor events, City-owned electric, water, and sewer utility system facilities, construction activities occurring within allowable hours, permitted fireworks displays, or permitted heliports. Construction activities are not permitted within 300 feet of residentially zoned property except within the hours of 7:00 a.m. and 6:00 p.m. on weekdays and 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

The City Code does not define the acoustical time descriptor such as L_{eq} (the average noise level) or L_{max} (the maximum instantaneous noise level) that is associated with the above limits. A reasonable interpretation of the City Code would identify the ambient base noise level criteria as an average or median noise level (L_{eq}/L_{50}).

Santa Clara County Airport Land Use Commission Comprehensive Land Use Plan. The Comprehensive Land Use Plan adopted by the Santa Clara County Airport land Use Commission contains standards for projects within the vicinity of San José International Airport which are relevant to this project;

<u>4.3.2.1 Noise Compatibility Policies</u>

Policy N-3 Noise impacts shall be evaluated according to the Aircraft Noise Contours presented on Figure 5 (2022 Aircraft Noise Contours).

Policy N-4 No residential or transient lodging construction shall be permitted within the 65 dB CNEL contour boundary unless it can be demonstrated that the resulting interior sound levels will be less than 45 dB CNEL and there are no outdoor patios or outdoor activity areas associated with the residential portion of a mixed use residential project or a multi-unit residential project. (Sound wall noise mitigation measures are not effective in reducing noise generated by aircraft flying overhead.)

Existing Noise Environment

The plan area is located at the eastern boundary of the City of Santa Clara, between the western bank of the Guadalupe River and Lafayette Street. The southern border of the planning area is Tasman Drive. The site's northern edge lies along the eastern portion of the Santa Clara Golf and Tennis Club. The Specific Plan area is adjacent to the Lick Mill Light Rail Transit Station on Tasman Drive and the Great America Station on the west side of Lafayette Street which is served by both the Altamont Commuter Express (ACE) and Amtrak. The surrounding land uses include light industrial and office uses.

A noise monitoring survey was performed in the plan area beginning on Tuesday, March 7, 2017 and concluding on Thursday, March 9, 2017. The monitoring survey included three long-term and seven short-term noise measurements, which are shown in Figure 1. The noise environment in the plan area and in the surrounding areas results primarily from vehicular traffic along Lafayette Street and Tasman Drive. Traffic along the local streets within the plan area, which include Calle Del Mundo and Calle De Luna, also affect the ambient noise environment. Additionally, the plan area is located approximately 36 feet north of the Lick Mill Light Rail Transit Station and 106 feet east of the Great America Station. Train passbys are audible at the site. Frequent overhead aircraft associated with the Mineta San José International Airport also contribute to ambient noise levels within the plan area and vicinity.

Long-term noise measurement LT-1 was made along the southernmost boundary of the plan area, near the Lick Mill Light Rail Transit Station. LT-1 was located approximately 62 feet north of the light-rail train (LRT) line on westbound Tasman Drive. Hourly average noise levels at this location typically ranged from 62 to 70 dBA L_{eq} during the day and from 52 to 72 dBA L_{eq} at night. The average community noise equivalent level for 24-hour periods occurring between Tuesday, March 7, 2017 and Thursday, March 9, 2017 was 68 dBA CNEL. The daily trends in noise levels at LT-1 are shown in Figure 2.

Long-term noise measurement LT-2 was made along Lafayette Street, halfway between Calle Del Mundo and Calle De Luna. LT-2 was approximately 56 feet from the centerline of Lafayette Street. Hourly average noise levels at this location typically ranged from 63 to 76 dBA L_{eq} during the day and from 53 to 74 dBA L_{eq} at night. The average community noise equivalent level for 24-hour periods occurring between Tuesday, March 7, 2017 and Thursday, March 9, 2017 was 72 dBA CNEL. The daily trends in noise levels at LT-2 are shown in Figure 3.

The final long-term measurement (LT-3) was made along the northern boundary of the project area, approximately 60 feet north of the centerline of Calle Del Mundo. Hourly average noise levels at this location typically ranged from 55 to 62 dBA L_{eq} during the day and from 49 to 62 dBA L_{eq} at night. The average community noise equivalent level for 24-hour periods occurring between Tuesday, March 7, 2017 and Thursday, March 9, 2017 was 62 dBA CNEL. The daily trends in noise levels at LT-3 are shown in Figure 4.

Short-term noise measurements, ST-1 through ST-7, were conducted on Thursday, March 9, 2017 in ten-minute intervals starting at 12:30 p.m. and concluding at 3:30 p.m. As shown in Figure 1, ST-1 was made at the residential neighborhood on the eastern bank of the Guadalupe River, away from traffic and LRT noise on Tasman Drive. ST-2 and ST-6 were made on the south side of Tasman Drive. ST-2 was made in the outdoor use area of the Riverwood Grove apartment complex and ST-6 was made in the common outdoor use area between Avenida De Los Alumnos and Plaza Corona. ST-3 and ST-5 were made at the west boundary of the plan area, adjacent to Lafayette Street. Measured noise levels at these locations were dominated by traffic noise along Lafayette Street and the Lafayette Street/Tasman Drive intersection. ST-4 and ST-7 were made in the parking lot of 2111 Tasman Drive and 5102 Calle Del Sol, respectively. At these locations, noise from vehicular traffic and LRT operations equally dominant the soundscape. Light rail trains at ST-7 were measured at 69 to 70 dBA. All short-term measurements are summarized in Table 5.

FIGURE 1 Noise and Vibration Measurement Locations

Figure 2

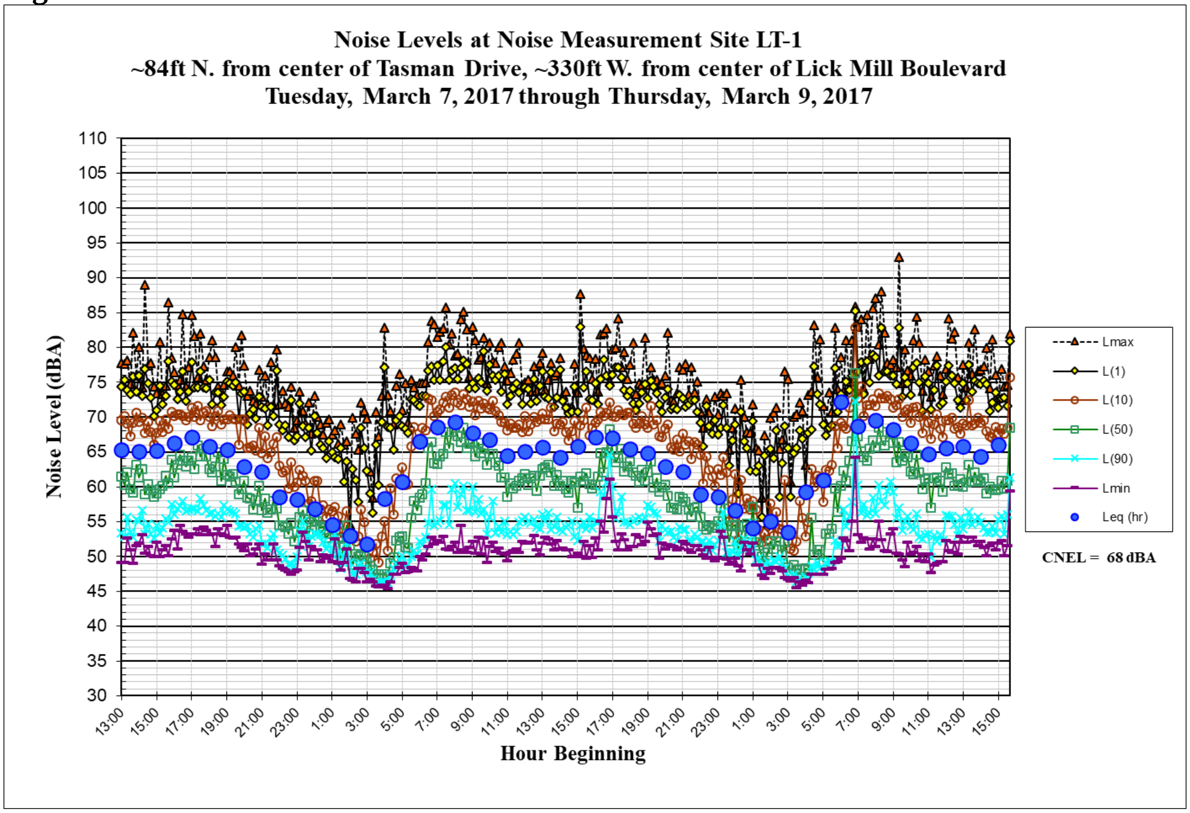


Figure 3

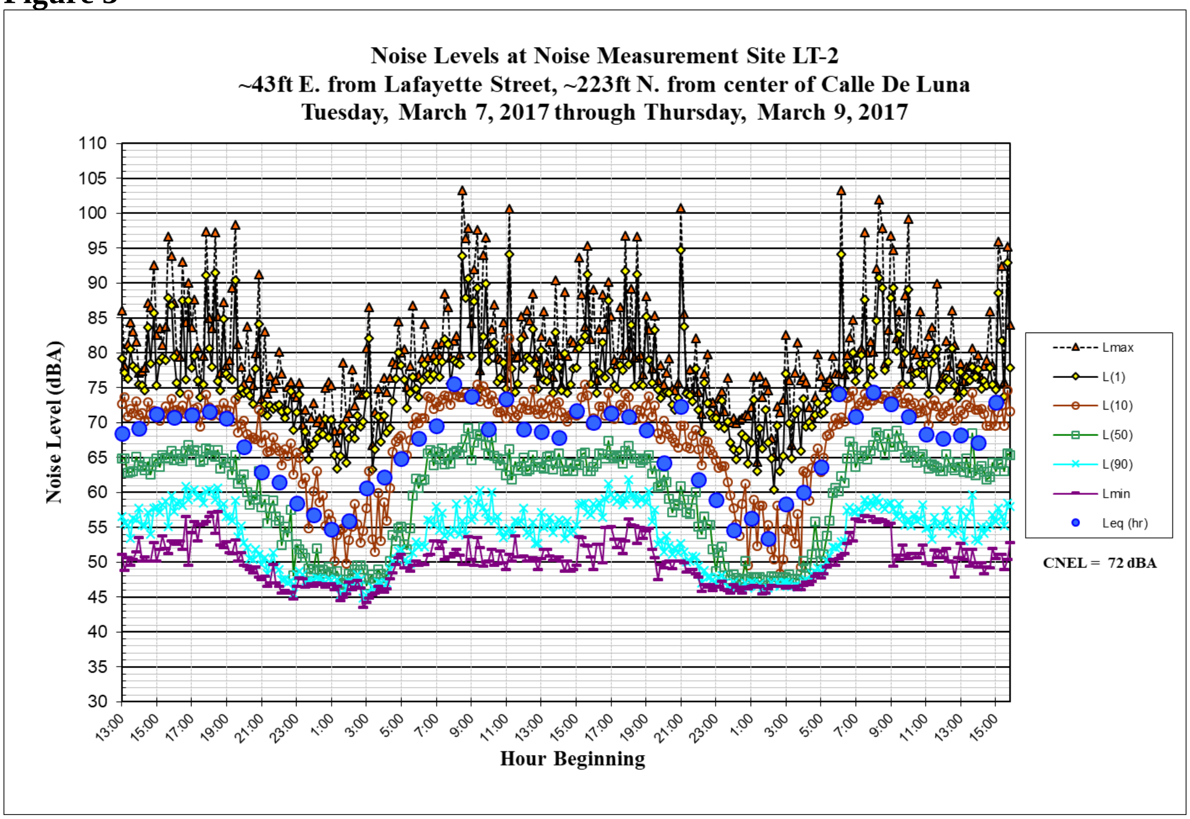


Figure 4

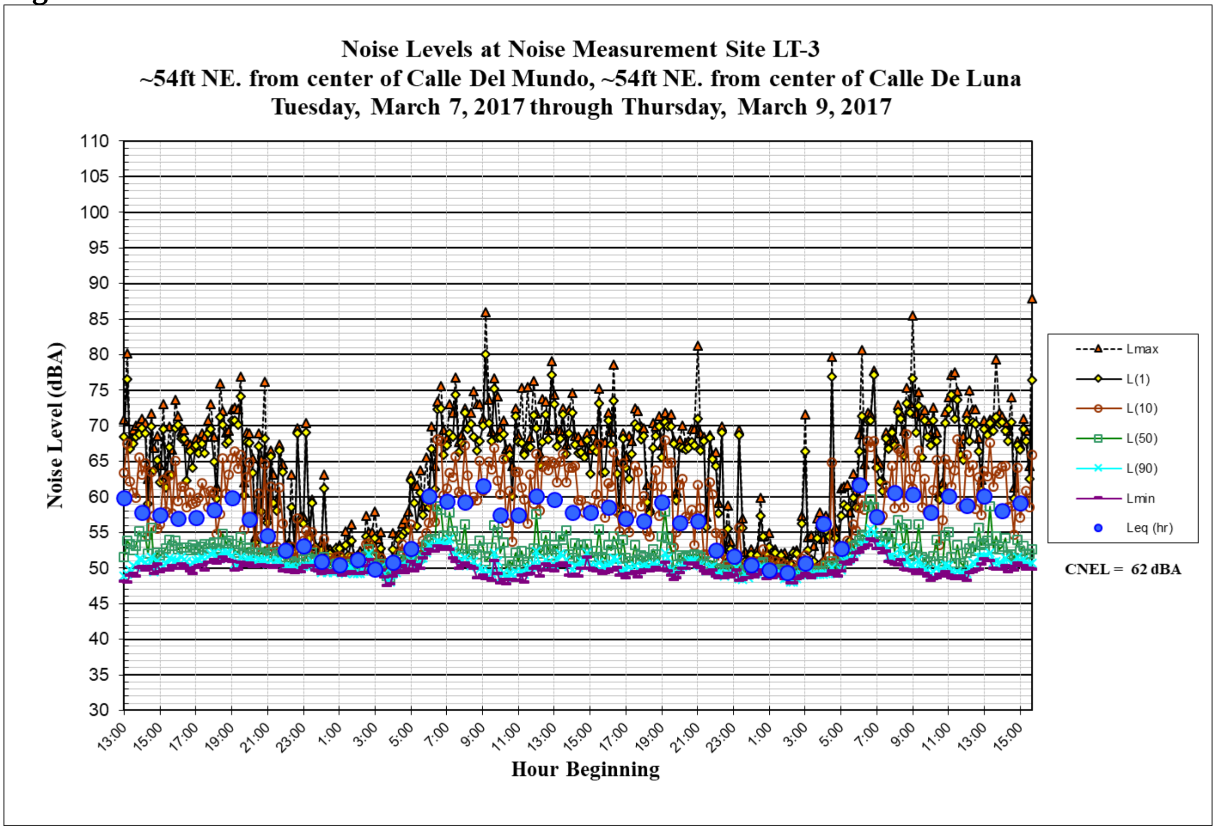


TABLE 5 Summary of Short-Term Noise Measurements (dBA)

Noise Measurement Location (Date, Time)	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}
ST-1: ~514 feet from Tasman Drive (3/9/2017, 12:30-12:40 p.m.)	59	57	52	44	40	48
ST-2: ~140 feet from Tasman Drive (3/9/2017, 12:50-1:00 p.m.)	75	74	66	50	48	62
ST-3: ~15 feet from Lafayette Street & ~170 feet from Calle Del Mundo (3/9/2017, 1:30-1:40 p.m.)	78	76	72	62	53	67
ST-4: ~140 feet from Tasman Drive (3/9/2017, 2:20-2:30 p.m.)	69	68	58	52	49	57
ST-5: ~30 feet from Lafayette Street & ~76 feet from Tasman Drive (3/9/2017, 2:40-2:50 p.m.)	73	70	66	60	54	62
ST-6: ~62 feet from Tasman Drive (3/9/2017, 3:00-3:10 p.m.)	71	70	64	56	51	61
ST-7: ~58 feet from Tasman Drive & ~652 feet from Lafayette Street (3/9/2017, 3:20-3:30 p.m.)	73	71	65	58	53	62

GENERAL PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

Future Exterior Noise Environment

The future noise environment within the plan area would continue to result from transportation-related noise sources, including vehicle traffic along Lafayette Street and Tasman Drive, heavy-rail and light-rail trains, and aircraft. Secondary noise sources would include vehicle traffic along Calle Del Mundo, Calle Del Luna, Calle Del Sol, and the future roadways to be constructed within the plan area. Within the project area, noise from mechanical equipment associated with existing commercial and industrial operations will also to contribute to the noise environment in localized areas.

A traffic study was conducted by *Fehr & Peers* for the proposed project.[1] The Cumulative Plus Project traffic condition provides the cumulative future traffic volumes expected at intersections in the vicinity of the plan area after full project build-out. For the purposes of the noise and land use compatibility evaluation, full project build-out conditions were assumed to calculate the future noise environment.

Traffic volumes along the segments of Lafayette Street and Tasman Drive bordering the project area are projected to increase, resulting in a noise level increase of 2 dBA along each roadway under Cumulative Plus Project conditions. According to the peak hour traffic volumes provided, the expected traffic noise increase along Calle Del Sol would be 3 dBA under Cumulative Plus Project conditions. Due to the low existing traffic volumes on the roadways located on the interior of the project area, the Federal Highway Administration's (FHWA) Traffic Noise Model version 2.5 (TNMv2.5) was used to estimate the future noise levels using the traffic volumes provided in the Cumulative Plus Project scenario. A new roadway, the Lick Mill Boulevard extension is expected to produce noise levels up to 65 dBA, 50 feet from the roadway centerline within the site.

Based on measurements made at the long-term measurement sites discussed above, future exterior noise levels resulting from a combination of traffic noise and aircraft noise would be 70 dBA CNEL at LT-1 along Tasman Drive, 74 dBA CNEL at LT-2 along Lafayette Street, and up to 67 dBA CNEL at LT-3 along the future Lick Mill Boulevard extension. These data, along with the TNM model estimates, are used in the following section to calculate the future exterior and interior noise levels at each development area.

Levi's Stadium, approximately 1,175 feet away from the project area, will periodically contribute to the noise environment during large events such as NFL games and concerts. Based on findings from the 2009 Stadium EIR, residences within 2,000 feet of the stadium would experience elevated exterior noise levels during events which would result in an unavoidable impact. Interior noise levels at proposed residential land uses can be mitigated with the incorporation of noise insulation features.

[1] *Fehr & Peers*, "SJ16_1669 Tasman East Focus Area Plan" Dec 2017.

Noise levels in outdoor use areas that are affected by transportation noise are required to be maintained at or below 55 dBA CNEL to be considered normally acceptable for residential land uses and at or below 65 dBA CNEL to be considered normally acceptable for outdoor recreational areas (such as parks), according to the City's General Plan.

High-Density Residential Areas

In mid/high density residential developments, private terraces or balconies are not typically considered sensitive to exterior noise levels. The goal is to provide a compatible noise environment in common outdoor areas. Aircraft noise exposure throughout the plan area exceeds 55 dBA CNEL, and it is not normally feasible to reduce aircraft noise in outdoor activity areas. Residential development is proposed along Lafayette Street and Tasman Drive where the noise exposure is projected to exceed 70 dBA CNEL, which would be incompatible with residential outdoor activity areas. Likewise, residential development is proposed along the future Lick Mill Boulevard extension where noise exposure is projected to exceed 60 dBA CNEL, which would be incompatible with residential outdoor activity areas.

Retail Areas

Retail areas planned for this area are required along certain frontage roads to support a walkable neighborhood. Preliminary plans show retail buildings being situated on Calle Del Sol. Current noise levels along Calle Del Sol range up to 68 dBA CNEL. Due to an anticipated increase in traffic volumes, retail units situated on Calle Del Sol are expected to experience sound levels up to 71 dBA CNEL. Based on Table 5-10.2 of the Santa Clara General Plan, noise levels here are acceptable if measures are taken to reduce interior noise at retail locations to acceptable levels.

Open Space Areas

The current Tasman East Specific Plan includes open space areas through a distributed park system. Current plans show that open space areas within the center of the site could be as close as 243 feet from Lafayette Street and 216 feet from Tasman Drive. At a distance of 243 feet from Lafayette Street, noise levels at a recreational park would be expected to be 64 dBA CNEL, not accounting for the shielding provided by intervening buildings. At a distance of 216 feet from Tasman Drive, noise levels at a recreational park would also be expected to be 64 dBA CNEL, not accounting for building shielding. These levels would be below the 65 dBA CNEL threshold of the Santa Clara General Plan.

The largest recreational space in the current plan is the Riverside Park bordering the Guadalupe River. Riverside Park may have features such as sport courts and an amphitheater. According to current plans, this park may possibly lie as close as 107 feet from the center of Tasman Drive. At this distance, noise levels from Tasman Drive would be expected to be 69 dBA CNEL, not accounting for building shielding, exceeding the 65 dBA CNEL threshold. However, the noise environment throughout most of the Riverside Park would be compatible. At a setback of 200 feet from the center of Tasman Drive, noise levels would be below the 65 dBA CNEL threshold. Between 107 and 200 feet, noise levels would be between 65 and 69 dBA CNEL. Similarly, areas of Riverside Park bordering the future Lick Mill Boulevard extension would be expected to experience noise levels exceeding the 65 dBA CNEL threshold. At a setback distance of 100 feet or more from Lick Mill Boulevard, noise levels would be expected to be below the 65 dBA CNEL threshold.

Design Measures to Reduce Future Exterior Noise Levels

The following measures shall be incorporated into the proposed plan to reduce exterior noise levels at common outdoor activity areas:

- Do not locate common outdoor activity areas immediately adjacent to Tasman Drive, Lafayette Street, or the future Lick Mill Boulevard extension.

- Utilize site planning by placing outdoor activity areas in courtyards, on shielded podium levels (sky gardens) or rooftops, or behind buildings adjoining Tasman Drive or Lafayette Street.

Future Interior Noise Environment

Commercial Land Uses

The Cal Green Code establishes that interior noise levels shall be maintained at 50 dBA $L_{eq(1\text{-}hr)}$ or less during hours of operation at any proposed commercial buildings. Standard commercial construction in California typically provides an outdoor-to-indoor noise reduction of about 30 dBA L_{eq}. At a distance of 50 feet from the center of Lafayette Street along the western edge of the plan area, the future noise level is calculated to be up to 77 dBA L_{eq}. At a distance of 65 feet from the center of Tasman Drive, along the southern edge of the plan area, the future noise level is calculated to be 74 dBA L_{eq}. Standard construction should result in compatible interior noise levels in commercial uses within the plan area.

Residential Land Uses

The City of Santa Clara requires that interior noise levels be maintained at 45 dBA CNEL or less for residences.

Interior noise levels would vary depending upon the design of the buildings (relative window area to wall area) and the selected construction materials and methods. Standard residential construction provides approximately 15 dBA of exterior to interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior noise levels range from 60 to 65 dBA CNEL, the inclusion of adequate forced-air mechanical ventilation is often the method selected to reduce interior noise levels to acceptable levels by closing the windows to control noise. Where noise levels exceed 65 dBA CNEL, forced-air mechanical ventilation systems and sound-rated construction methods are normally required. Such methods or materials may include a combination of smaller window and door sizes as a percentage of the total building façade facing the noise source, sound-rated windows and doors, sound rated exterior wall assemblies, and mechanical ventilation so windows may be kept closed at the occupant's discretion.

At a distance of 50 feet from the southern and western border of the proposed plan area, sound levels are proposed to range from 72 to 74 dBA CNEL. Future interior noise levels at the plan area would be up to 55 dBA CNEL, exceeding the 45 dBA CNEL threshold of the Santa Clara General Plan.

Design Measures to Reduce Future Interior Noise Levels

The following measures are recommended to reduce interior noise levels at future residences bordering both Lafayette Street and Tasman Drive to 45 dBA CNEL or less:

- Assuming a conservative estimated ratio of 30 percent windows/doors to total wall area, preliminary calculations indicate that the facades of high-density residential buildings having line-of-sight to Lafayette Street would require windows and doors with a minimum STC rating of 30 to meet the interior noise threshold established by the City.

- Along the façades having direct line-of-sight to Tasman Drive and Lick Mill Boulevard, the minimum required STC for windows and doors would be 26.

- Provide a suitable form of forced-air mechanical ventilation, as determined by the local building official, for all residential units in the plan area so that windows can be kept closed at the occupant's discretion to control interior noise and achieve the interior noise standards.

- A qualified acoustical consultant shall review the final site plans, building elevations, and floor plans of the proposed residential buildings and make recommendations for noise insulation to reduce interior noise levels to 45 dBA CNEL or less. Treatments would include, but are not limited to, forced-air mechanical ventilation systems, sound-rated wall and window constructions, acoustical caulking, protected ventilation openings, etc. The specific determination of what noise insulation treatments are necessary shall be conducted during final design of the project. Results of the analysis, including the description of the necessary noise control treatments, shall be submitted to the City, along with the building plans and approved design, prior to issuance of a building permit.

Vibration and Land Use Compatibility

The U.S. Department of Transportation, Federal Transit Administration's (FTA) vibration impact assessment criteria[2] were used to evaluate vibration levels produced by trains passing the project area. The FTA vibration impact criteria are based on maximum overall levels for a single event. The impact criteria for groundborne vibration are shown in Table 6. Note that there are criteria for frequent events (more than 70 events of the same source per day), occasional events (30 to 70

[2] U.S. Department of Transportation, Federal Transit Administration, Transit Noise and Vibration Impact Assessment, May 2006, FTA-VA-90-1003-06.

vibration events of the same source per day), and infrequent events (less than 30 vibration events of the same source per day).

Observed and recorded vibration measurements of individual train activity through Great America Station and Lick Mill Station were conducted on March 9, 2016. The instrumentation used to conduct the measurements included an Edirol model R-09HR solid state recorder and seismic grade, low noise accelerometers firmly fixed to the ground. This system is capable of accurately measuring very low vibration levels. Vibration levels were measured at ground level and were representative of the levels that would enter a building's foundation.

A total of three (3) individual Amtrak train passbys and ten (10) individual light rail train passbys were observed and recorded at two locations within the plan area. Amtrak trains were monitored at distances of 110 and 140 feet east from the edge of the tracks across form Lafayette Street. Light rail trains were monitored at distances of 55 to 88 feet north from the nearest track on Tasman Drive. Vibration levels were measured in the vertical axis because ground vibration is typically most dominant on this axis. Noise and vibration monitoring locations are shown on Figure 1. Vibration levels measured at each measurement position during train passby events can be seen in Figures 5 through 10. Single heavy rail train events from Great America Station measured up to 51 VdB at a distance of 110 feet from the tracks. Single light rail train events at Lick Mill Station measured up to 52 VdB at a distance of 55 feet from the tracks. At these levels, train vibration would be below all vibration thresholds according to Table 6. Railroad and light-rail train vibration would be compatible with the proposed project.

TABLE 6 Groundborne Vibration Impact Criteria

Land Use Category	Groundborne Vibration Impact Levels (VdB re 1 μinch/sec, RMS)		
	Frequent Events[1]	**Occasional Events[2]**	**Infrequent Events[3]**
Category 1 Buildings where vibration would interfere with interior operations.	65 VdB[4]	65 VdB[4]	65 VdB[4]
Category 2 Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB
Category 3 Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB

Notes:
1. "Frequent Events" is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
2. "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
3. "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.
4. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research should always require detailed evaluation to define the acceptable vibration levels. Ensuring low vibration levels in a building requires special design of HVAC systems and stiffened floors.

Figure 5

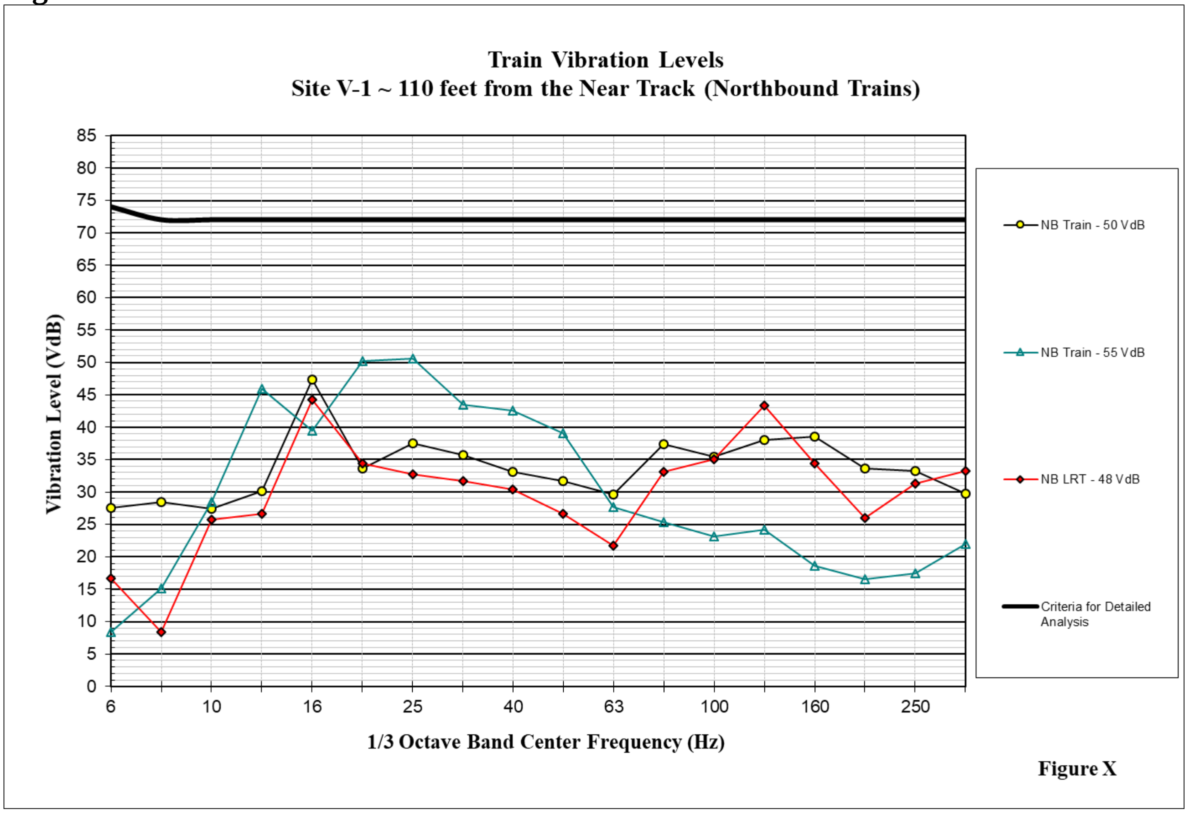


Figure 6

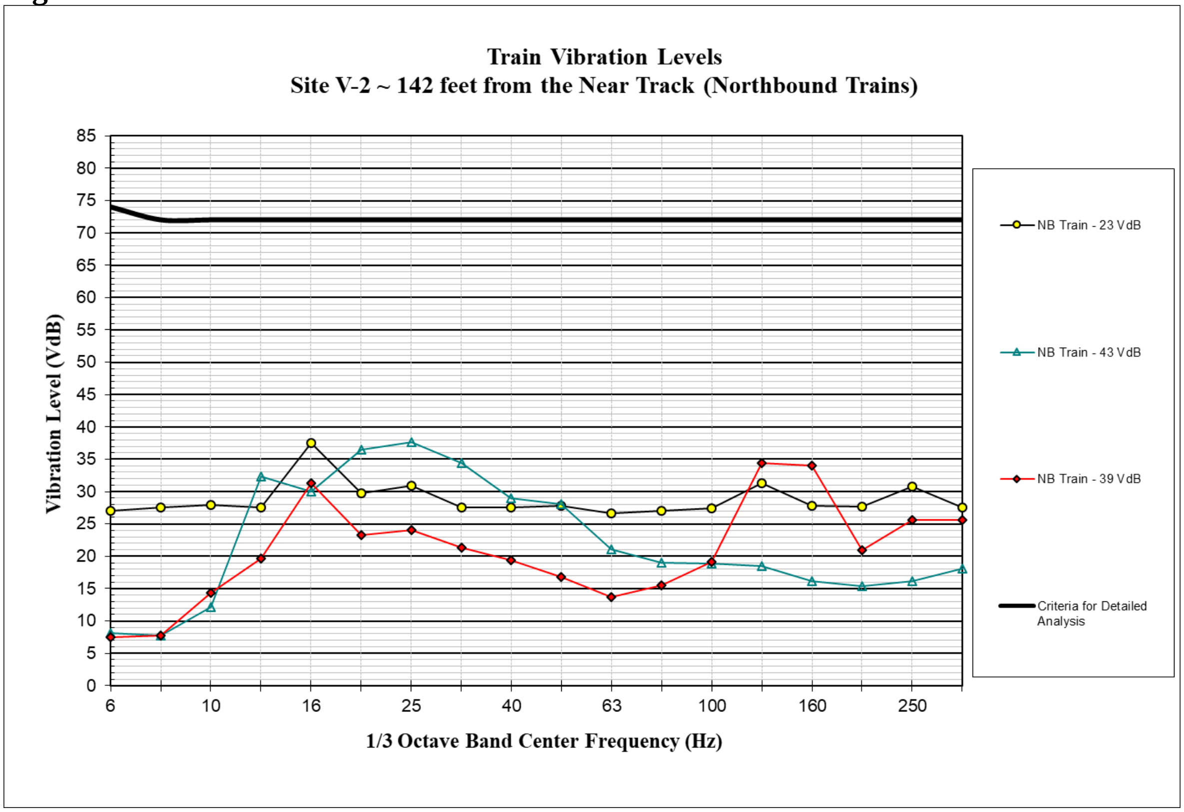


Figure 7

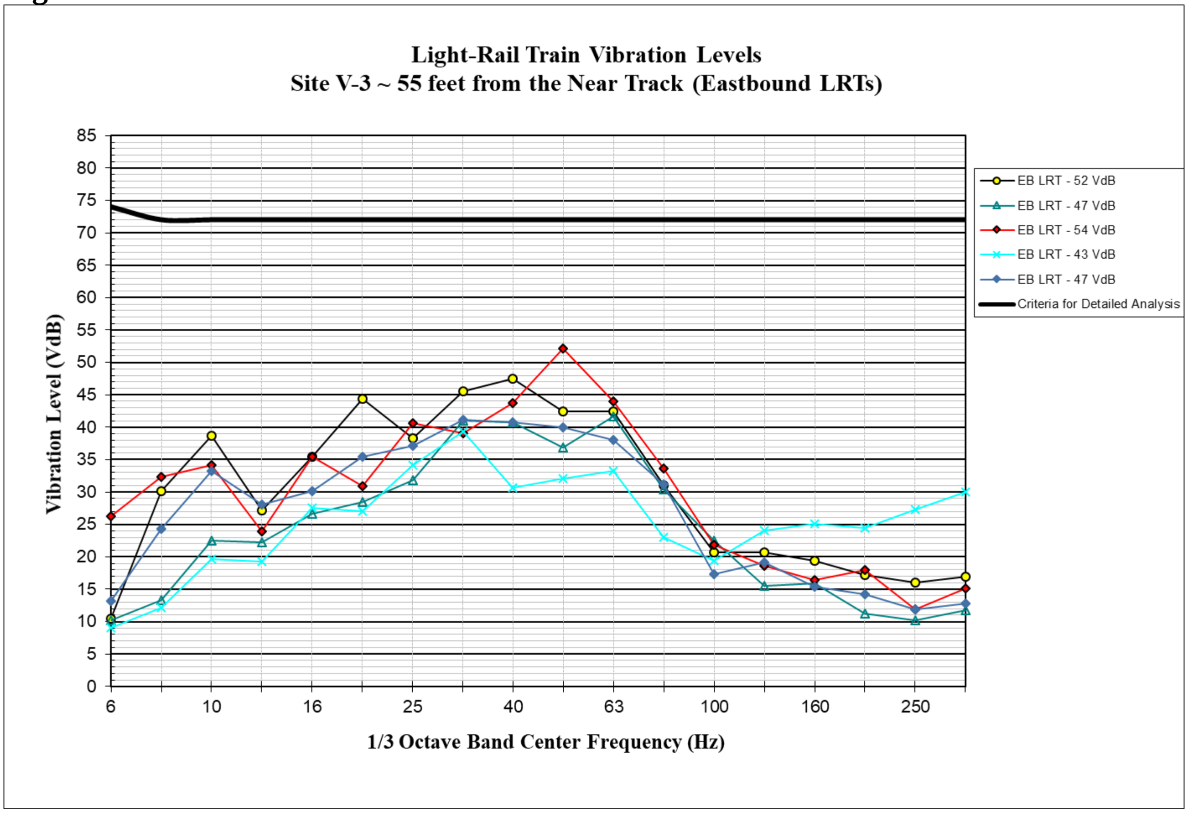


Figure 8

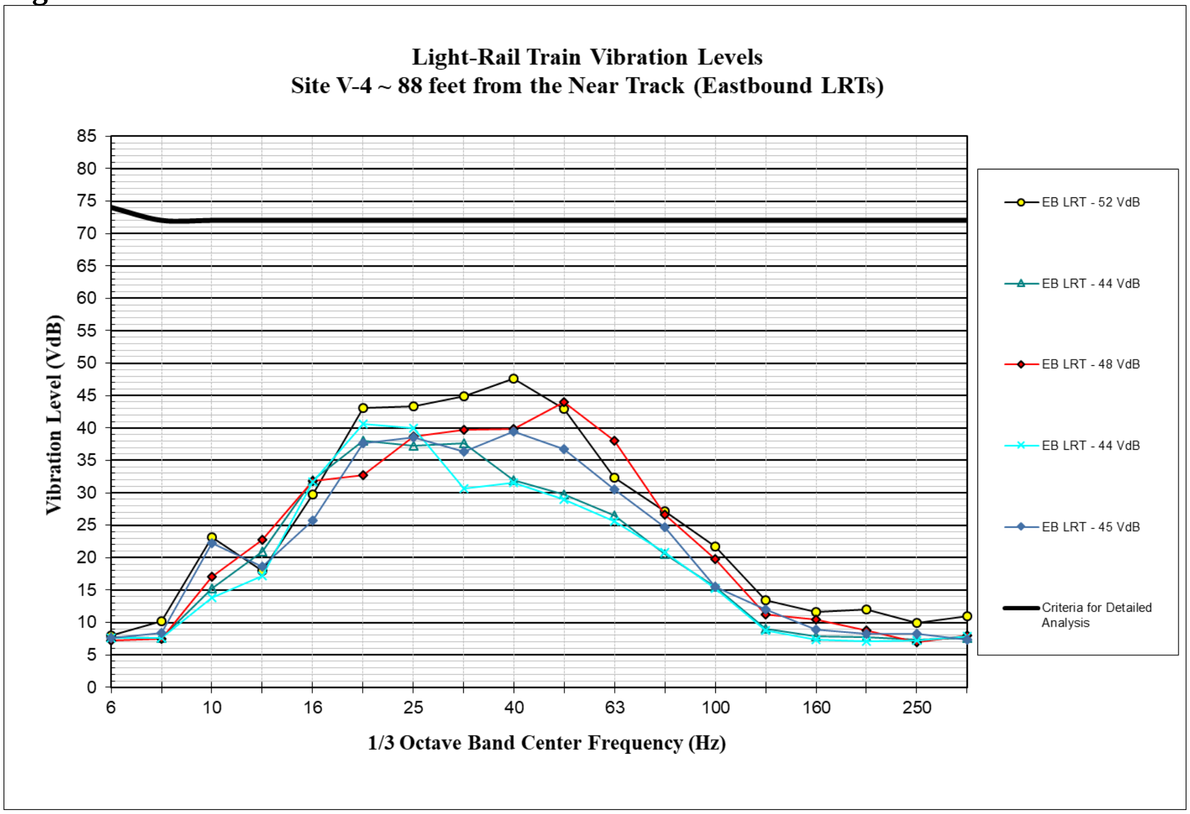


Figure 9

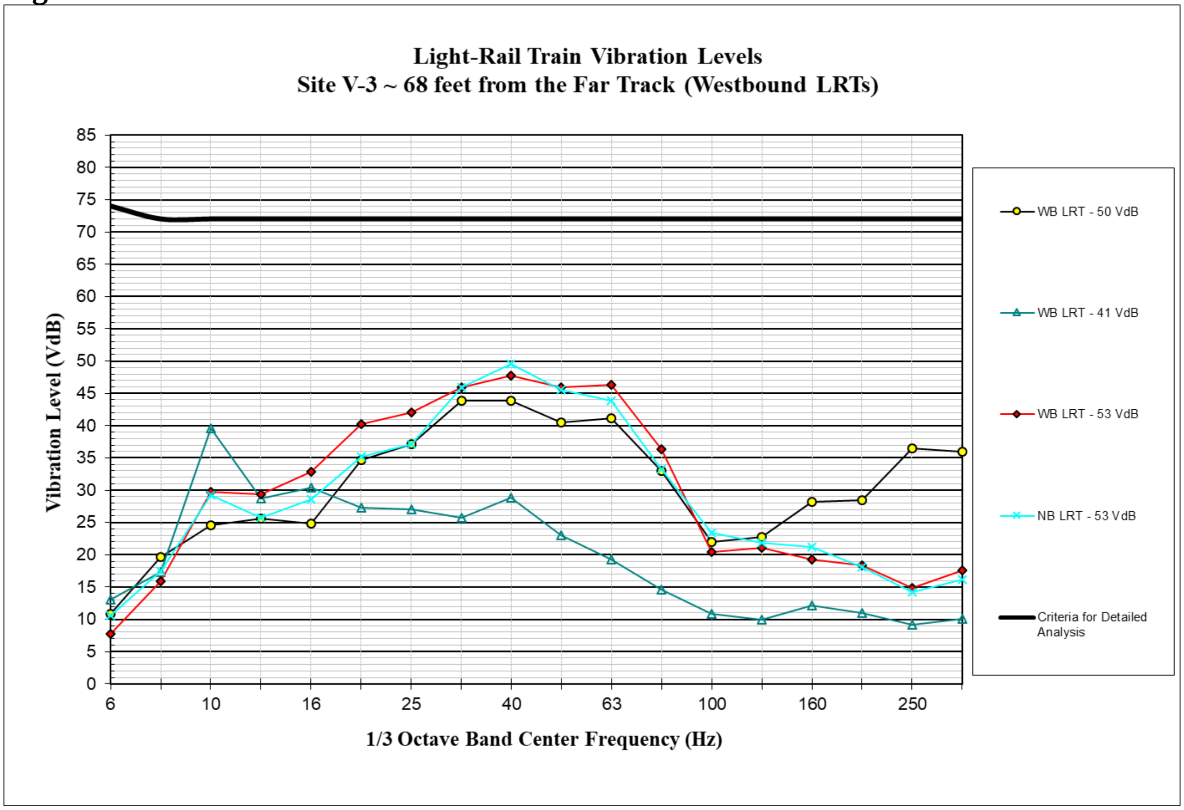
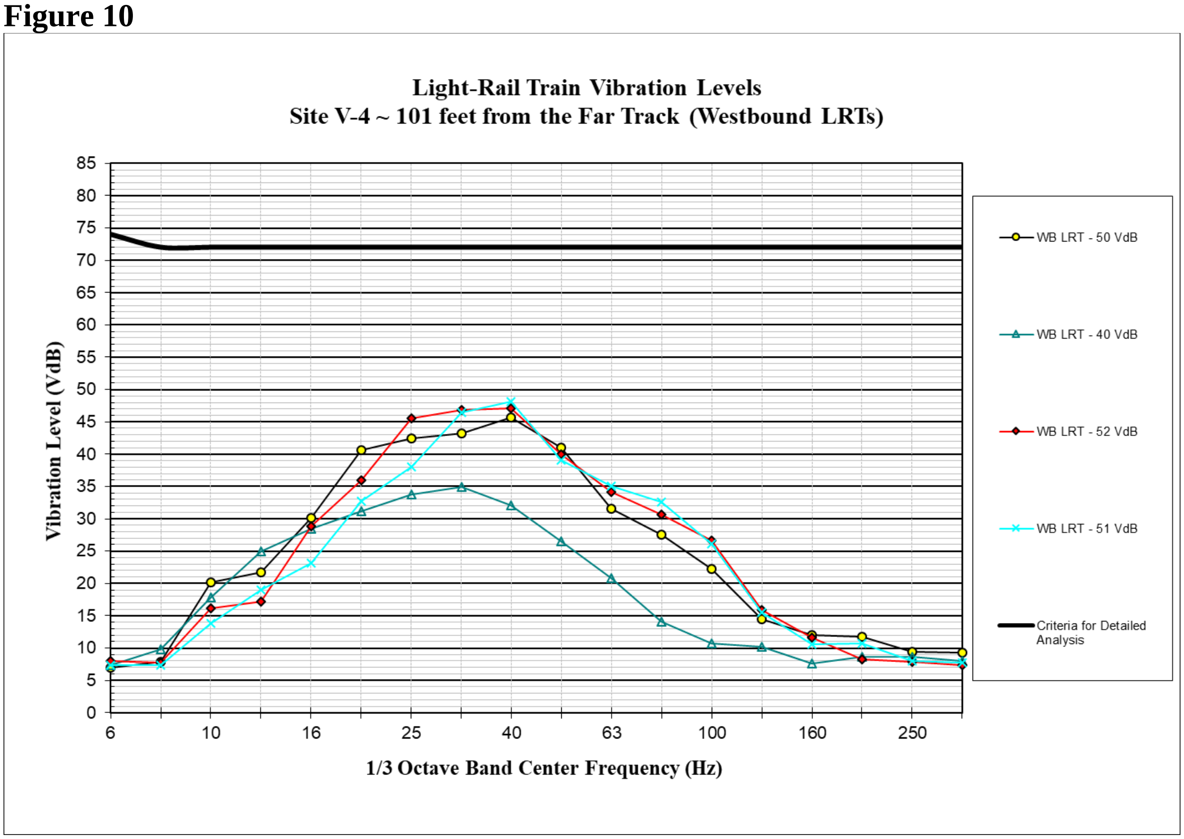


Figure 10



NOISE IMPACTS AND MITIGATION MEASURES

Noise Sensitive Receptors

The nearest existing noise-sensitive land uses, which consist of multi-family residences, are located approximately 800 feet south from the center of the plan area, adjacent to Tasman Drive. Additional multi-family housing, including high-rise apartments, are located approximately 1,450 feet to the east. Some commercial use such as restaurants are located about 1,200 feet to the west of the plan area. Due to the distance from the plan area and the noise contributors surrounding these existing receptors, noise and vibration due to plan-generated sources would be minimal at these existing off-site receptors.

City Place, an approved 240-acre mixed-use development, has the potential to also become a noise sensitive receptor. Office buildings, retail and entertainment facilities, residential units, and hotel rooms have the potential to be within 680 feet of the center of the proposed project site. These new receptors would be affected by construction noise and vibration during the construction of buildings and infrastructure within the planning area.

Significance Criteria

The following criteria were used to evaluate the significance of environmental noise resulting from the project:

- A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan or Municipal Code.

- A significant impact would be identified if the construction of the project would expose persons to excessive vibration levels. Ground-borne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.

- A significant impact would be identified if traffic generated by the project or project improvements/operations would substantially increase noise levels at sensitive receivers in the vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA CNEL or greater, with a future noise level of less than 55 dBA CNEL, or b) the noise level increase is 3 dBA CNEL or greater, with a future noise level of 55 dBA CNEL or greater.

- A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. Hourly average noise levels exceeding 60 dBA L_{eq}, and the ambient environment by at least 5 dBA L_{eq}, for a period of more than one year would constitute a significant temporary noise increase at adjacent residential land uses. Hourly average noise levels exceeding 70 dBA L_{eq} at the property lines shared with commercial land uses, and the ambient by at least 5 dBA L_{eq}, for a period of more than one year would also constitute a significant temporary noise.

Impact 1: **Noise Levels in Excess of Standards.** The proposed project could potentially generate noise in excess of the City's exterior noise guidelines for fixed sources of noise and in excess of ambient noise levels. **This is a potentially significant impact.**

Mechanical Equipment

Buildings developed within the Tasman East Specific Plan would have mechanical equipment, such as heating, ventilation, and air conditioning systems. Under the City of Santa Clara Municipal Code, noise generated by fixed sources of noise would be restricted to 55 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and to 50 dBA during nighttime hours (10:00 p.m. to 7:00 a.m.) at residential land uses.

Mechanical equipment noise would potentially impact adjacent on-site noise-sensitive receptors as well as multi-family housing to the south and east of the site. Typical air conditioning units and heat pumps for multi-family residences generate noise levels between 55 and 60 dBA L_{eq} at a distance of 50 feet per unit. The current plans do not include information regarding the number, type, or size of the mechanical equipment units that would be required as part of the project. Without this information and without knowing the placement of the equipment on or surrounding the proposed buildings, calculations cannot be made regarding noise levels at the nearest multi-family dwellings off site. Due to the number of variables inherent in the mechanical equipment needs of buildings within the Tasman East Specific Plan (number and type of units, locations, size, housing or enclosures, etc.), the impacts of mechanical equipment noise on adjacent noise-sensitive uses are **conservatively identified as a potentially significant impact** and shall be assessed during the final stage of projects facilitated by the Specific Plan.

Truck Circulation and Loading Activities

Noise measurements made by *Illingworth & Rodkin, Inc.* at grocery and large retail stores indicate that the highest noise levels generated by the retail uses in the proposed Tasman East Specific Plan would typically result from delivery and garbage trucks circulating to and from the docking area at a grocery store. Heavy truck deliveries typically generate maximum instantaneous noise levels of 70 to 75 dBA L_{max} at a distance of 50 feet. Smaller vendor trucks, which would be expected at the potential smaller retail uses within the plan area, would generate maximum noise levels ranging from 65 to 70 dBA L_{max} at a distance of 50 feet. Low speed truck noise results from a combination of engine, exhaust, and tire noise, as well as the intermittent sounds of back-up alarms and releases of compressed air associated with truck/trailer air-brakes. The noise level of backup alarms can vary depending on the type and directivity of the sound, but maximum noise levels are typically in the range of 65 to 75 dBA L_{max} at a distance of 50 feet. Noise generated by loading dock activities and slow-moving trucks would drop off at a rate of about 6 dB per doubling of distance between the noise source and receptor.

While details regarding the location of the loading docks and the type of retail uses were not available at the time of this study, truck circulation and loading activities would affect the residents surrounding the proposed commercial uses. Based on short term measurements at locations ST-6 and ST-7, typical maximum instantaneous noise levels from truck circulation and loading activities would be consistent with current ambient noise. At a distance of 50 feet from Tasman, current maximum instantaneous noise levels typically range from 70 to 75 dBA L_{max}. These levels are consistent with future truck circulation and loading activities associated with the specific plan. Without knowing the placement of retail or commercial buildings, exact calculations cannot be made regarding noise levels at potential sensitive receptors on and off site. **Noise from truck circulation and loading activities was therefore conservatively identified as a potentially significant impact.**

Construction Noise

According to the City's Municipal Code, noise limits are not applicable to construction activities occurring within the allowable hours of 7:00 a.m. and 6:00 p.m. Monday through Friday and 9:00 a.m. and 6:00 p.m. on Saturdays. Construction activities for the proposed Tasman East Specific Plan would not occur on Sundays or holidays, as specified in the Municipal Code. This is a less-than-significant impact.

Mitigation Measure 1:

Mechanical equipment shall be selected and designed to reduce impacts on surrounding uses to meet the City's Municipal Code noise limits of 55 dBA during the daytime and 50 dBA at night. A qualified acoustical consultant shall be retained to review mechanical noise as these systems are selected to determine specific noise reduction measures necessary to reduce noise to comply with the City's Municipal Code. Design planning for mechanical equipment shall take into account the noise criteria associated with such equipment and use site planning to locate equipment in less noise-sensitive areas, where feasible. Noise reduction measures could include, but are not limited to, selection of equipment that emits low noise levels and/installation of noise barriers such as enclosures and parapet walls to block the line of sight between the noise source and the nearest receptors.

Loading docks shall be designed to reduce impacts on surrounding uses to meet the City's Municipal Code noise limits of 55 dBA during the daytime and 50 dBA at night. A qualified acoustical consultant shall be retained to review proposed loading dock areas to determine specific noise reduction measures necessary to reduce noise to comply with the City's Municipal Code. Noise reduction measures could include, but are not limited to:

- Locate loading zones inside (e.g., within parking structures), where possible, and as far from adjacent residential uses as possible.

- Implement a no idling policy at all retail locations that requires engines to be turned off after five minutes.

- Recess truck docks into the ground.

- Equip loading bay doors with rubberized gasket type seals to allow little loading noise to escape.

- Limit deliveries to the hours between 7 a.m. and 10 p.m. daily.

Project-level analyses shall be submitted to the City of Santa Clara for review and approval prior to issuance of any building permits. Implementation of these mitigation measures would reduce this impact to a less-than-significant level.

Impact 2: **Exposure to Excessive Ground-borne Vibration.** Typical construction-related vibration is not expected to produce vibration levels that would exceed 0.3 in/sec PPV at off-site and on-site buildings. However, possible pile driving activities could produce vibration levels above 0.3 in/sec PPV and construction vibration could at times be perceptible at on-site receptors. **This is a potentially significant impact.**

The construction of the Tasman East Specific Plan may generate perceptible vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used. Construction activities would include site demolition, preparation work, foundation work, and new building framing and finishing. Buildings developed within the Tasman East Specific Plan may or may not require pile driving, which can cause excessive vibration.

For structural damage, the California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, which typically consist of buildings constructed since the 1990s. A conservative vibration limit of 0.3 in/sec PPV has been used for buildings that are found to be structurally sound but where structural damage is a major concern (see Table 3 above for further explanation). For historical buildings or buildings that are documented to be structurally weakened, a conservative limit of 0.08 in/sec PPV is often used to provide the highest level of protection. No historical buildings or buildings that are documented to be structurally weakened adjoin the project area; further, no existing residential land uses are located within the immediate vicinity of the project area. For the purposes of this study, ground-borne vibration levels exceeding the conservative 0.3 in/sec PPV limit at the existing nearby residences would have the potential to result in a significant vibration impact, and for recent developments, ground-borne vibration in excess of 0.5 in/sec PPV would be considered significant.

Table 7 presents typical vibration levels that could be expected from construction equipment at distances of 25 feet (reference distance) and 121 feet (distance to nearest sensitive receiver). Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.) may generate substantial vibration in the immediate vicinity. Vibration levels would vary depending on soil conditions, construction methods, and equipment used.

The nearest future off-site buildings are located approximately 121 feet north of the plan area, opposite a future City Place roadway. At this distance, vibration levels from construction activities, including pile driving, would be expected to be below 0.2 in/sec PPV, which would not exceed the 0.3 in/sec PPV significance threshold. All other off-site buildings have distances greater than 121 feet from the plan area border. Vibration levels at these buildings would not exceed 0.3 in/sec PPV.

Depending on the Tasman Specific Plan build out, the existing commercial and industrial buildings located on the future development parcel would be exposed to construction vibration. Likewise, future completed residential developments may be exposed to construction vibration from other developments in the area. With the exclusion of pile driving, new construction up to 18 feet away from existing commercial buildings and future developments has the potential to exceed the 0.3 in/sec PPV threshold. Accounting for possible pile driving, new construction up to 86 feet away from existing commercial buildings and future developments has the potential to exceed the 0.3 in/sec PPV threshold. This is potentially a significant impact. While the construction-generated vibration levels for the proposed project would not result in "architectural" damage at any existing or future project buildings on or surrounding the site, construction activities could at times be perceptible.

TABLE 7 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	PPV at 121 ft. (in/sec)
Pile Driver (Impact)	upper range	1.158	0.204
	typical	0.644	0.114
Pile Driver (Sonic)	upper range	0.734	0.130
	typical	0.170	0.030
Clam shovel drop		0.202	0.036
Hydromill (slurry wall)	in soil	0.008	0.001
	in rock	0.017	0.003
Vibratory Roller		0.210	0.037
Hoe Ram		0.089	0.016
Large bulldozer		0.089	0.016
Caisson drilling		0.089	0.016
Loaded trucks		0.076	0.013
Jackhammer		0.035	0.006
Small bulldozer		0.003	0.001

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

Mitigation Measure 2:

The following mitigation measures are recommended to avoid all potential impacts related to excessive ground-borne construction vibration and to reduce perceptibility at noise-sensitive sites:

- Comply with construction hours ordinance to limit hours of exposure. The City's Municipal Code limits construction activities within 300 feet of residentially zoned property to the hours of 7:00 a.m. to 6:00 p.m. on weekdays and between the hours of 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

- Minimize or avoid using vibratory rollers and tampers near sensitive areas, such as shared property lines with residential land uses. Whenever possible, use cast-in-drilled-holes piles for projects requiring deep foundations to reduce construction vibration.

- When vibration-sensitive structures are within 18 feet of a project development site or within 86 feet of a project proposing pile-driving, survey condition of existing structures and, when necessary due to the structure type and resulting vibration due to the construction activities proposed, perform site-specific vibration studies to direct construction activities. Contractors shall continue to monitor effects of construction activities on surveyed sensitive structures and offer repair or compensation for damage. The results of the vibration monitoring shall be summarized and submitted in a report to the Community Development Director prior to issuance of an occupancy permit.

- Construction management plans for substantial construction projects, particularly those involving pile driving, shall include predefined vibration reduction measures, notification requirements for properties within 200 feet of scheduled construction activities, and contact information for on-site coordination and complaints. The construction management plan shall be submitted to the City prior to issuance of a demolition or grading permit.

- Include a disclosure in the lease of the future tenants within the Tasman East Specific Plan properties that provides information regarding the on-going construction activities within the area.

Critical factors pertaining to the impact of construction vibration on sensitive receptors include the proximity of the existing structures to the project area, the soundness of the structures, and the methods of construction used. The implementation of these mitigation measures would reduce a potential impact to a less-than-significant level.

Impact 3: **Project-generated Traffic Noise.** The proposed project would not result in a permanent noise level increase at the existing residential land uses in the project vicinity. **This is a less-than-significant impact.**

A significant impact would occur if the permanent noise level increase due to project-generated traffic at existing noise-sensitive receptors was 3 dBA CNEL or greater for existing levels exceeding 55 dBA CNEL or was 5 dBA CNEL or greater for existing levels at or below 55 dBA CNEL. To determine noise level increases at existing residential land uses due to project-generated traffic, existing plus project peak hour traffic conditions from the *Fehr & Peers* traffic study were compared to the existing peak hour traffic conditions. For the Tasman East Specific Plan, a total of 39 intersections were evaluated for peak hour traffic volumes. The intersection of Tasman Drive and Lick Mill Boulevard is shown to have an increase in traffic noise of 1 dBA near sensitive residential receptors to the south. All other traffic segments are shown to have noise increases lower than 1 dBA. Therefore, the future increase in traffic volumes would not cause a permanent noise increases of 3 dBA or greater at the nearest noise-sensitive receptors. This impact is a less-than-significant impact.

Impact 4: **Temporary Construction Noise.** Existing noise-sensitive land uses would potentially be exposed to construction noise levels in excess of the significance thresholds for a period of more than one year. Existing commercial and industrial buildings in the site have the potential to be exposed to construction noise levels in excess of the significance threshold for a period longer than one year. **This is a potentially significant impact**.

Noise impacts resulting from construction depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), when the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time. Where noise from construction activities exceeds 60 dBA L_{eq} and exceeds the ambient noise environment by at least 5 dBA L_{eq} at noise-sensitive uses in the project vicinity for a period exceeding one year, the impact would be considered significant.

Construction noise levels vary on a day-to-day basis depending on the type and amount of equipment operating on site and the specific task that is being completed on a particular day. Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The highest maximum noise levels generated by project construction would typically range from about 80 to 90 dBA L_{max} at a distance of 50 feet from the noise source (Table 8). Typical hourly average construction-generated noise levels for residential developments are about 81 to 88 dBA L_{eq} measured at a distance of 50 feet from the center of the site during busy construction periods (e.g., earth moving equipment, impact tools, etc.). The noise levels associated with construction of the building would be substantially less than the noise levels associated with grading and paving. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain can provide an additional 5 to 10 dBA noise reduction at distant receptors.

The construction phasing and buildout schedule for the plan area is uncertain. One scenario consists of construction initially occurring on the outer rim of the project area. This assumption would include four different buildout sites on the northern, eastern, southern, and western boundaries of the plan area. For the purposes of this analysis, these individual zones are used to calculate construction noise levels.

The nearest existing noise-sensitive receptors, which are multi-family residences, are located approximately 280 feet south of the southern buildout. At this distance, hourly average noise levels due to construction noise would range from 63 to 74 dBA L_{eq}, which would exceed 60 dBA $L_{eq,}$ and the current ambient noise level by 5 dBA L_{eq}. To the east, multi-family residences exist 690 feet from the eastern buildout of the site. At this distance, hourly average noise levels due to construction noise would range from 55 to 66 dBA L_{eq}, which would exceed 60 dBA L_{eq} and the current ambient noise level by 5 dBA L_{eq}.

During the buildout of the Tasman East Specific Plan, any completed on-site residences would be exposed to construction noise levels exceeding 60 dBA L_{eq}, and exceeding ambient noise levels by more than 5 dBA L_{eq}. Construction would be on-going when these residents move into their dwellings so they should be properly notified.

During each stage of construction, there would be a different mix of equipment operating, and noise levels would vary by stage and vary within stages, based on the amount of equipment in operation and the location at which the equipment is operating. Table 9 shows the average noise level ranges, by construction phase. The highest noise levels would be generated during demolition, excavation, grading, and foundation construction. Noise generated during the construction of the proposed structures is generally lower as less heavy construction equipment is required to complete the task. Once construction moves indoors, minimal noise would be generated at off-site locations. Construction phasing was unknown at the time of this study. However, it is expected that full buildout of the Tasman East Specific Plan will likely occur over the next 20 years. Furthermore, developments bordering the site-specific plan are expected to be under construction for over a year. Due to construction activities causing noise levels at nearby sensitive receptors in excess of 60 dBA L_{eq} and exceeding the ambient noise environment by at least 5 dBA L_{eq}**, this would be a significant impact.**

TABLE 8 Construction Equipment, 50-foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous

All other equipment with engines larger than 5 HP	85	Continuous

Notes: [1] Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.
[2] Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.
[3]Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

TABLE 9 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	II	I	II	I	II	I	II
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84
I - All pertinent equipment present at site. **II** - Minimum required equipment present at site.								

Source: U.S.E.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

Mitigation Measure 4:

Construction equipment should be well-maintained and used judiciously to be as quiet as possible. Additionally, the following construction best management practices are recommended to reduce construction noise levels emanating from the Tasman East Specific Plan and minimize disruption and annoyance at existing noise-sensitive receptors in the project vicinity and future noise-sensitive receptors developed during the initial phases of development. The City shall require the construction crew to adhere to the following construction best management practices to reduce construction noise levels emanating from the site and minimize disruption and annoyance at existing noise-sensitive receptors in the project vicinity.

Construction Best Management Practices

Develop a construction noise control plan, including, but not limited to, the following available controls:

- Ensure that construction activities (including the loading and unloading of materials and truck movements) within 300 feet of residentially zoned property are limited to the hours of 7:00 a.m. to 6:00 p.m. on weekdays and between the hours of 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

- Ensure that excavating, grading and filling activities (including warming of equipment motors) within 300 feet of residentially zoned property are limited to the hours of 7:00 a.m.

to 6:00 p.m. on weekdays and between the hours of 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

- Contractors equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment.

- Contractors utilize “quiet” models of air compressors and other stationary noise sources where technology exists.

- Locate loading, staging areas, stationary noise-generating equipment, etc. as far as feasible from sensitive receptors when sensitive receptors adjoin or are near a construction project area. Construct temporary noise barriers to screen stationary noise-generating equipment when located near adjoining sensitive land uses. Temporary noise barriers can reduce construction noise levels by 5 dBA.

- Control noise from construction workers’ radios to a point where they are not audible at existing residences bordering the project area.

- Comply with Air Resource Board idling prohibitions of uneasy idling of internal combustion engines.

- Construct solid plywood fences around construction sites adjacent to operational business, residences or noise-sensitive land uses.

- A temporary noise control blanket barrier could be erected, if necessary, along building facades facing construction sites. This mitigation would only be necessary if conflicts occurred which were irresolvable by proper scheduling.

- Route construction-related traffic along major roadways and as far as feasible from sensitive receptors.

- Businesses, residences or noise-sensitive land uses adjacent to construction sites should be notified of the construction schedule in writing. Designate a "construction liaison" that would be responsible for responding to any local complaints about construction noise. The liaison would determine the cause of the noise complaints (e.g., starting too early, bad muffler, etc.) and institute reasonable measures to correct the problem. Conspicuously post a telephone number for the liaison at the construction site.

- Include a disclosure in the lease of the future tenants within the Tasman East Specific Plan properties that provides information regarding the on-going construction activities within the area.

If pile driving occurs, the following best management practices should be included:

- Schedule pile driving during a period when school is not in session.

- During pile driving, pre-drill foundation pile holes to minimize the number of impacts required to seat the pile.

- During pile driving activities, install "acoustical blankets" to provide shielding for receptors located within 100 feet of the site, or use of a noise attenuating shroud on the pile driving hammer.

Implementation of these measures would reduce construction noise levels emanating from the Tasman East Specific Plan and minimize disruption and annoyance. With the implementation of these measures, the lack of high-intensity construction equipment required for the proposed project, and the fact that noise generated by construction activities would occur over a temporary period, the temporary increase in ambient noise levels at the proposed plan area would be a less-than-significant impact.

Impact 5: **Cumulative Noise Increase.** The proposed project would not result in a permanent noise level increase at the existing residential land uses in the project vicinity. **This is a less-than-significant impact.**

A significant impact would occur if two criteria are met: 1) if the cumulative traffic noise level increase was 3 dBA CNEL or greater for existing levels exceeding 55 dBA CNEL or was 5 dBA CNEL or greater for existing levels at or below 55 dBA CNEL; and 2) if the project would make a "cumulatively considerable" contribution to the overall traffic noise increase. A "cumulatively considerable" contribution would be defined as an increase of 1 dBA CNEL or more attributable solely to the proposed project.

Cumulative traffic noise level increases were calculated by comparing the Cumulative No Project traffic volumes and the Cumulative Plus Project volumes to Existing traffic volumes. A traffic noise increase of 3 dBA CNEL was calculated under both cumulative scenarios (cumulative no project and cumulative plus project) along multiple roadway segments in Santa Clara. No segments resulted in both a noise level increase of 3 dBA CNEL and a cumulatively considerable contribution from project traffic to the overall traffic noise increase. This would be a less-than-significant impact.

Impact 6: **Cumulative Construction Noise.** Existing land uses in the project vicinity would not be exposed to construction noise levels that would be considered cumulatively significant. **This is a less-than-significant impact.**

The proposed project may contribute to cumulative construction noise levels resulting from the development of pending projects, and projects that are approved, but have not started construction. Construction of City Place, an adjacent development to the plan area, has the greatest likelihood of overlapping construction noise.

The nearest sensitive common noise receptor for both the Tasman East Specific Plan and City Place would be the residences just south of Tasman Drive. From the City Place EIR, construction noise from City Place construction would cause noise levels of 66 dBA L_{eq} at the neighborhood border to Tasman Drive. At the same location, construction noise contributions from Plan developments would be up to 74 dBA L_{eq}. At these levels, construction levels would increase by at most 1 dBA. A worst case cumulative construction noise increase of 1 dBA from the project in combination with City Place would not make a noticeable increase to the overall construction noise level.

In addition, the Tasman East Specific Plan proposes to implement the construction best management practices identified above to reduce construction noise levels emanating from the site. Similar controls are proposed as part of the City Place project. Since cumulative construction noise levels would not be noticeably higher than construction noise levels expected from the individual projects alone, the cumulative construction noise impact would be considered less-than-significant.

Impact 7: **Existing Aircraft Noise.** Noise levels due to aircraft would be compatible with the Norman Y. Mineta San José International Airport Master Plan. **This is a less-than-significant impact.**

Mineta San José International Airport is a public-use airport located approximately 2.5 miles south of the project area. The project area lies outside the 2027 65 dBA CNEL noise contour shown in the Norman Y. Mineta San José International Airport Master Plan Update Project for the airport. [3] The proposed project lies inside the 60 dBA CNEL noise contour. An interpolation of the contours indicates that future aircraft noise levels would reach 62 dBA CNEL at the project area. Such noise levels would be compatible with the proposed land uses with respect to the guidelines set forth in the Airport Master Plan. This would be a less-than-significant impact.

[3] City of San José, "Norman Y. Mineta San José International Airport Master Plan Update Project: Eighth Addendum to the Environmental Impact Report," City of San José Public Project File No. PP 10-024, February 10, 2010.